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REMARKS

ON THE

FAUNA OF THE QUEBEC GROUP OF ROCKS,

AND THE

PRIMORDIAL ZONE OF CANADA,

ADDRESSED TO

MR. JOACHIM BARRANDE.

BY

SIR W. E. LOGAN,

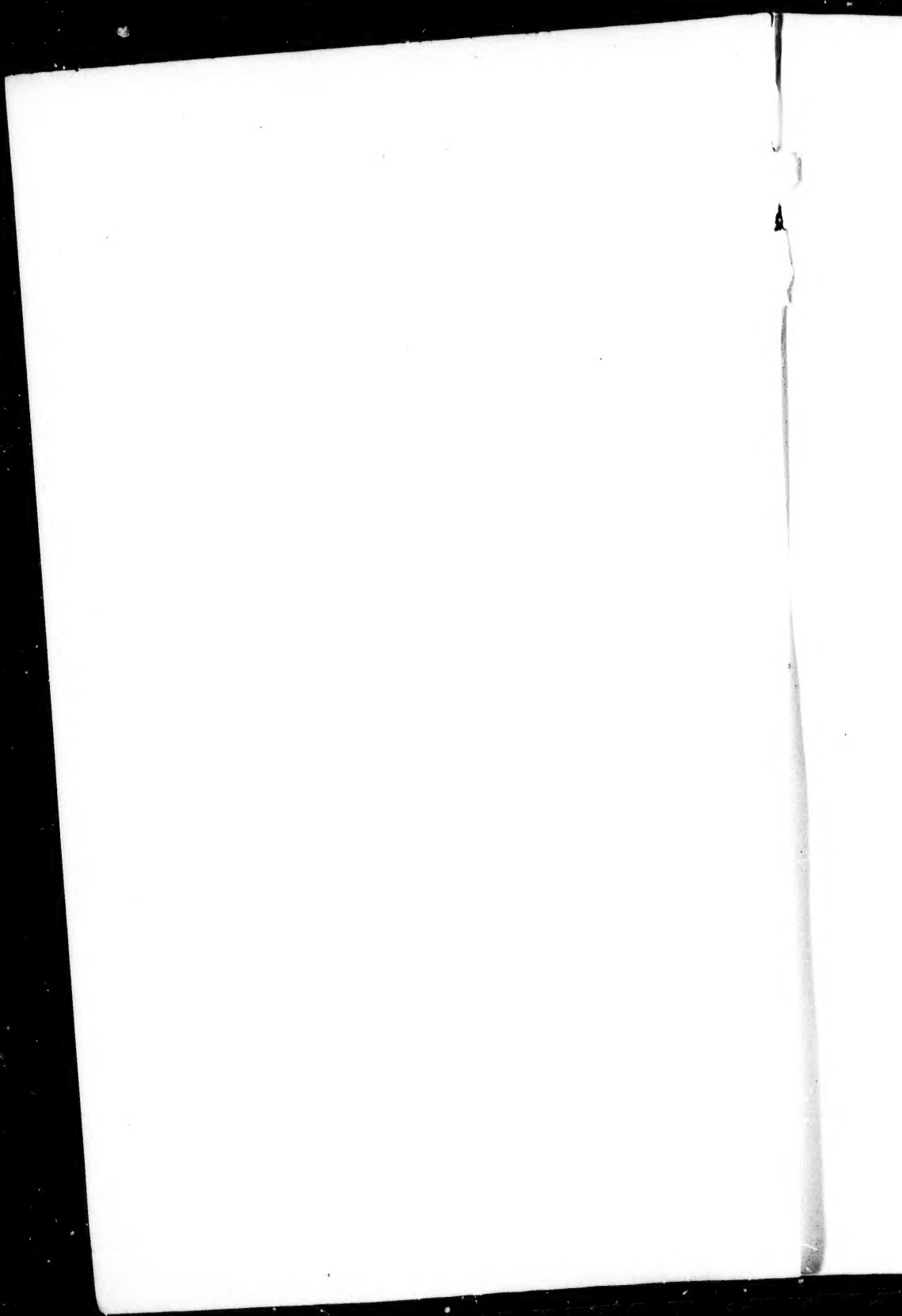
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Montreal:

PRINTED BY JOHN LOVELL, ST. NICHOLAS STREET.

3RD JAN., 1861.



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MONTREAL, 31st Dec., 1860.

MY DEAR MR. BARRANDE,

I am much indebted to you for your letter of the 6th August, which was accompanied by a copy of your communication to Professor Bronn of Heidelberg, dated 16th July. Agreeably to your request, I took an early opportunity of letting Mr. Hall have a copy of your communication to Prof. Bronn, and he received it on the 11th or 12th September.

I am of course aware, from the correspondence you have had with my friend Mr. Billings and myself, how far you are acquainted with our discoveries at Quebec. On two occasions, just previous to the receipt of your last letter to Mr. Billings (received the 8th November), I devoted the short time I could spare from other engagements connected with the Geological Survey, to farther researches at Point Levi. I have satisfied myself, notwithstanding the conglomerate aspect of the bands of rock which contain our new fossils, that the fossils are of the age of the strata. Without entering at present on minute details of structure, I may say that the chief part of the specimens, found up to this time, are from two parallel out-crops, which might be taken as representing two distinct layers. If they are such, they are comprehended in a thickness of about 150 feet; but the circumstances of the case, connected with the physical structure, make it probable that the one band is a repetition of the other through the influence of an anticlinal fold or a dislocation. Both out-crops dip to the south-eastward.

From the more northern out-crop (which we shall call A²) we have obtained *Orthis* 1, *Leptæna* 1, *Camerella* 1, *Lingula* 2, *Discina* 1, *Agnostus* 3,

Conocephalites 1, *Arionellus* 4, *Dikelocephalus* 6, *Bathyrus* 4. From the more southern out-crop (which we shall call A²) we have *Dictyonema* 1, *Orthis* 2, *Leptaena* 1, *Strophomena* 1, *Camerella* 1, *Cyrtodonta* (?) 1, *Murchisonia* 3, *Pleurotomaria* 7, *Helicotoma* 2, *Straparollus* 2, *Capulus* 2, *Agnostus* 1, *Bathyrus* 4, *Cheirurus* 2, *Amphion* 2. From a third out-crop, which is still farther southward, and supposed to be another repetition of the same band (which we shall call A¹), we have *Orthis* 1, *Camerella* 1, *Asaphus* (*A. Illænoides*) 1, *Bathyrus* 1. Tracing A² or A³ round the extremity of a synclinal, and finding occasional indications of the fossils of A² and A³, we arrive at a position on the south side of the synclinal. We shall call the position P. Here the band A² or A³ ends, but a bed of sandstone a little above it is traceable over an anticlinal to a junction with a conglomerate band lower than A² or A³, shewing that A² or A³ must merge into it. Call this A¹. In this we have *Asaphus* (*A. Illænoides*) 1, *Menocephalus* (*M. globosus*) 1. These two species occur in the same fragment of rock. Of all these fossils, 1 *Orthis* is common to A², A³ and A¹; 1 *Leptaena*, 1 *Camerella*, 1 *Lingula*, 1 *Agnostus*, and 1 *Bathyrus*, are common to A² and A³; 1 *Asaphus* is common to A³ and A¹.

The dip at P is to the south-eastward, and therefore an inverted dip. North-west of this, and therefore above it, at such a distance as would give a thickness of between 200 or 300 feet, we have a band of shale with nodules of limestone, the nodules made up of other rounded masses in a matrix holding fossils, many of them silicified. From a few of these compound nodules we have obtained *Orthis* 11, *Leptaena* 1; this band we shall call B¹. A band like this occurs about half a mile or more to the south-westward. It may be a higher band, or it may be the same band, but we shall call it B². From this we obtain *Crinoidæa* (columns) 3, *Orthis* 1, *Camerella* 1, *Nautilus* 1, *Orthoceras* 1, *Leperditia* 1, *Trilobites* (2 genera undetermined) 2. In another position to the south-east, on the south-east of the same anticlinal previously mentioned, we meet with a conglomerate band supposed to be the same as B²; but, in case it should be different, we shall call it B³. Here we have *Orthis* 3, *Pleurotomaria* 2, *Murchisonia* 1, *Ophileta* 1, *Helicotoma* 1, *Nautilus* 1, *Maclurea* 1, *Orthoceras* 3 or 4, *Cyrtoceras* 1, *Bathyrus* 1, *Illæus* 2, *Asaphus* 1. Of all these fossils, 1 *Orthis* and 1 *Camerella* are common to B¹ and B²; the same *Orthis* and *Camerella* with 1 *Leptaena* are common to B¹, A¹, A² and A³.

To the north of all these exposures, and on the north-west side of a synclinal running parallel with the synclinal already mentioned, fossils have been obtained in a cliff of about 100 feet, composed of limestone conglomerate, thin bedded limestones and shales. Their equivalence is not yet quite certain, but the strata are supposed to be not far removed

from A¹ and A². We shall call this cliff A. The fossils from it are *Tetradium* 1, *Orthis* 1, *Lingula* 2, *Trilobites* (genus undescribed) 1, with a great collection of compound *Graptolida*, described and being described by Mr. Hall under the genera *Graptolithus* 25, *Retiolites* 1, *Reteograptus* 2, *Phyllograptus* 5, *Dendrograptus* 3, *Thamnograptus* 3, *Dictyonema*, 3.

I have given you these details of localities, because as the subject requires further investigation we do not yet wish to commit ourselves entirely as to the equivalency of separate exposures. But there is no doubt that the whole is one group of strata deposited under one set of alternating circumstances. The whole fauna, as known up to the present time, is composed of—

Articulata,.....	36 species.
Mollusca,	55 “
Graptolida,	42 “
Radiata,.....	4 “

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Of this fauna not one species is found in the Anticosti group, where we have a gradual passage from the fauna of the Hudson River formation to that of the Clinton, and not one of any formation higher than the Chazy. Mr. Billings recognises one species, *Maclurea Atlantica* (Billings) as belonging to the Chazy, and six species as belonging to the Calciferous. They are *Lingula Mantelli* (Billings), *Camerella* undescribed, *Eccutimphalus* undescribed, *Helicotoma uniangulata* (Hall), *H. perstriata* (Billings), and one remarkable species of an undetermined genus, like a very convex *Cyrtodonta*, which occurs both at Mingan and Point Levi. All of the forms, particularly the trilobites, remind the observer of those figured by Mr. Dale Owen from the oldest fossiliferous rocks of the Mississippi valley, while independent of the six species identical with Chazy and Calciferous forms, there are many others closely allied to those found in the latter formation in Canada.

From the physical structure alone no person would suspect the break that must exist in the neighbourhood of Quebec, and without the evidence of the fossils, every one would be authorized to deny it. If there had been only one or two species of an ancient type, your own doctrine of colonies might have explained the matter, but this I presume would scarcely be applicable to so many identities in a fauna of such an aspect. Since there must be a break, it will not be very difficult to point out its course and its character. The whole Quebec group, from the base of the magnesian conglomerates and their accompanying magnesian shales to the summit of the Sillery sandstones, must have a thickness of perhaps some 5000 or 7000 feet. It appears to be a great develop-

ment of strata about the horizon of the Chazy and Calciferous, and it is brought to the surface by an overturn anticlinal fold with a crack and a great dislocation running along the summit, by which the Quebec group is brought to overlap the Hudson River formation. Sometimes it may overlies the overturned Utica formation, and in Vermont points of the overturned Trenton appear occasionally to emerge from beneath the overlap.

A series of such dislocations traverses eastern North America from Alabama to Canada. They have been described by Messieurs Rogers, and by Mr. Safford. The one in question comes upon the boundary of the Province not over a couple of miles from Lake Champlain. From this it proceeds in a gently curving line to Quebec, keeping just north of the fortress; thence it coasts the north side of the Island of Orleans, leaving a narrow margin on the island for the Hudson River or Utica formation. From near the east end of the island it keeps under the waters of the St. Lawrence to within eighty miles of the extremity of Gaspé. Here again it leaves a strip of the Hudson River or Utica formation on the coast.

To the south-east of this line the Quebec group is arranged in long narrow parallel synclinal forms with many overturn dips. These synclinal forms are separated from one another on the main anticlinals by dark grey and even black shales and limestones. These have heretofore been taken by me for shales and limestones of the Hudson River formation, which they strongly resemble, but as they separate the synclinals of the Quebec group must now be considered older. I am not prepared to say that the Potsdam deposit in its typical form of a sandstone is anywhere largely developed above these shales, where the shales are in greatest force. Neither am I prepared to assert its absence, as there are in some places masses of granular quartzite, not far removed from the magnesian rocks of the Quebec group, which require farther investigation; but, from finding wind-mark and ripple-mark on closely succeeding layers of the Potsdam sandstone where it rests immediately upon the Laurentian series, we know that this arenaceous portion of the formation must have been deposited immediately contiguous to the coast of the ancient Silurian sea, where part of it was even exposed at the ebb of tide. Out in deep water the deposit may have been a black partially calcareous mud, such as would give the shales and limestones which come from beneath the Quebec group.

In Canada no fossils have yet been found in these shales, but the shales resemble those in which *Oleni* have been found in Georgia (Vermont). These shales appear to be interposed between eastward dipping rocks equivalent to the magnesian strata of the Quebec group, and they may be brought up by an overlapping anticlinal or dislocation. We are thus led to believe that these shales and limestones, which may be subordinate

to the Potsdam formation, will represent the true primordial zone in Canada.

Mr. Murray has this season ascertained that the lowest rock that is well characterized by its fossils in the neighbourhood of Sault Ste. Marie, near Lake Superior, really belongs to the Birdseye and Black River group, and that it rests on the sandstones of Ste. Marie and Lacloche, the fossiliferous beds at the latter place being tinged with the red color of the sandstone immediately below them. These underlying Lake Superior rocks may thus be Chazy, Calceiferous, and Potsdam, and may be equivalent to the Quebec group and the black colored shales beneath. The Lake Superior group is the upper copper-bearing series of that region, and rests unconformably upon the lower copper-bearing series, which is the Huronian system. The upper copper-bearing series holds nearly all the metals, including gold, and so does the Quebec group, each making an important metalliferous region. Each when unmetamorphosed holds a vast collection of red colored strata. The want of fossils in the Lake Superior group makes it difficult to draw lines of division, but if any part represents the primordial zone, I should hazard the conjecture that it is the dark colored slates of Kamanistiquia, which underlie all the red rocks.

Professor Emmons has long maintained, on evidence that has been much disputed, that rocks in Vermont, which in June 1859 I for the first time saw and recognized as equivalent to the magnesian part of the Quebec group, are older than the Birdseye formation; the fossils which have this year been obtained at Quebec pretty clearly demonstrate that in this he is right. It is at the same time satisfactory to find that the view which Mr. Billings expressed to you in his letter of the 12th July, to the effect that the Quebec trilobites appeared to him to be about the base of the second fauna, should so well accord with your opinions; and that what we were last spring disposed to regard at Georgia as a colony in the second fauna, should so soon be proved, by the discoveries at Quebec, to be a constituent part of the primordial zone.

I am, my dear Mr. Barrande,

Very truly yours,

W. E. LOGAN.

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